Art XI.—*Variations in the Anatomy of Hyla aurea.*

By GEORGINA SWEET, D.Sc.,

Melbourne University.

(With Plates XIX., XX.).

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A number of variations in the morphology of this form have been already described (see Bibliography), but one occasionally comes across others, during the dissection of the numbers which pass through the hands of Junior Students in Biological Laboratories. It is desirable that a record should be made of these. Accordingly there are gathered together here the more important of those noticed during the last few years in the Biological Laboratory of the University of Melbourne. I wish to thank Professor Baldwin Spencer, Dr. T. S. Hall and others for directing my attention to variations which might not otherwise have come under my notice.

I.—Blood Vessels.

(i).—Arteries.

There have recently come under my notice three individuals of this species, two of which (A and B) have 4 aortic arches on either side instead of 3, as in a normal specimen, the third (C) having 4 arches on the one side, but only 3 on the other. One of these was found some years ago, one in 1907, one in 1908. In each (see Text figures 1-3) the additional arch lies

Fig 1

Specimen A of *Hyla aurea*, having four arterial arches in the adult.

1. Carotid arch.
2. Systemic arch.
3. Vestigial arch.
4. Pulmo-cutaneous arch

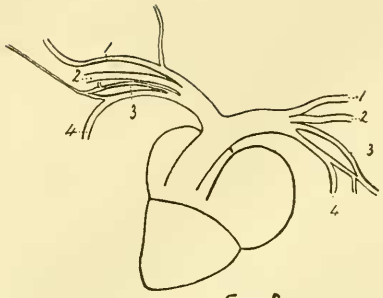


FIG 2

Specimen B of *Hyla aurea*, having four arterial arches in the adult.

(Reference letters as in Text-figure 1).

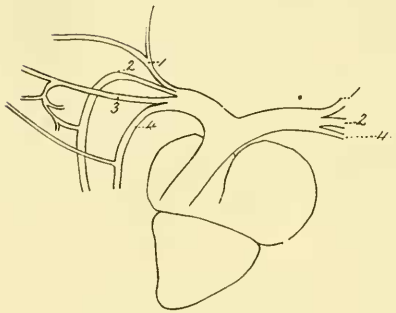


FIG 3

Specimen C of *Hyla aurea*, having four arterial arches in the adult.

(Reference letters as in Text-figure 1).

between the systemic and pulmo-cutaneous arches, and arises from the pulmo-cutaneous arch, close to its origin from the right or left half of the truncus arteriosus. It then runs outwards between the muscles, M. petrohyoideus II. and III., and on one side (R) of individual A, it coils about considerably dorsal to M. petrohyoideus III. and ventral to the systemic arch, which crosses the path of this vessel on its way round the oesophagus. In both A and B, and on each side, the extra arch opens into the cutaneous artery soon after the latter leaves the pulmo-cutaneous arch. In individual A (Text figure 1) the extra arch divides into two vessels, one coiling round to meet the cutaneous artery, the other running forwards and outwards to the skin. In the other individual B (Text figure 2) the extra arch does not coil, but runs almost straight into the cutaneous artery, giving off just before this union, a small vessel which runs inwards to the muscles of the laryngeal wall. I was unable to determine whether the systemic also gave off a

vessel to the larynx, as it had been cut previously to coming into my possession. There was in this animal no vessel to be found corresponding to that going to the skin from the extra arch in the other individual. In C (Text figure 3) the extra arch on the R. side does not open into the cutaneous artery at all, but gives off a large and long branch, accompanying it to its destination. The rest of this arch curls inwards to open into the systemic arch after giving off branches to the surrounding muscles.

It is quite evident that this extra arch corresponds to the 3rd branchial arch of the embryo which normally disappears in the frog, but has in these cases been retained.

In a fourth individual (Text figure 4) there were only the

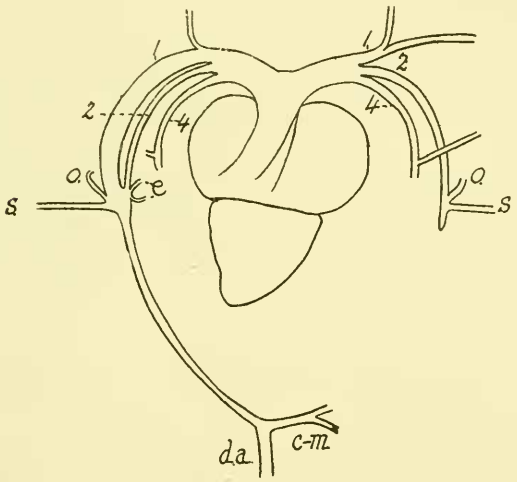


FIG 4.

Individual of *Hyla aurea*, showing abnormal Carotid and Systemic arches.

1. Carotid arch.
2. Systemic arch.
4. Pulmo-cutaneous arch.
o. Occipital artery.
s. Subclavian artery.
e. Oesophageal arteries.
d.a. Dorsal aorta.
c.-m. Coeliaco-mesenteric artery.

usual 3 arches, of which only the L. carotid and R. and L. pulmo-cutaneous arches are normal. The right carotid arch, after giving off the lingual artery, continues round as an abnormally large vessel to empty into the right systemic arch just where the latter gives off the occipital and subclavian arteries, and two branches to the roof and sides of the oesophagus. There is no branch corresponding in destination to the ordinary carotid artery on this R. side. On the left side the carotid arch is normal, but the left systemic arch ends abruptly just after giving off the occipital and subclavian arteries.

Thus we have here on the right side a disappearance of the part of the right half of the dorsal aorta anterior to the 1st branchial arch of the tadpole; while the connection between this arch and the 2nd arch, which usually persists as a solid, connective-tissue thread, the ductus Botalli, is here still widely open.

On the left side, the part of the left half of the dorsal aorta posterior to the origin of the subclavian artery has disappeared. It is difficult to understand how the brain gets its normal supply of blood, since the right carotid artery is absent, and no other vessel appears to take its place, and the left carotid artery is only normal in size and distribution. The arteries in general appear less subject to variation than do the veins. It may be noticed that occasionally the oesophageal arteries leave the systemic arch behind instead of in front of the subclavian arteries.

(ii).—Veins.

These show a curious tendency to split into 2 branches, reuniting a little distance on, thus forming a loop (see Text figure 5) generally not surrounding any special structure. This

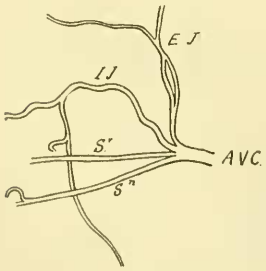


FIG 5

Abnormalities in veins belonging to the precaval system of *Hyla aurea*.

A.V.C. Anterior Vena Cava.
E.J. External Jugular Vein.
I.J. Internal Jugular Vein.
I. Innominate Vein.
S^v. Subscapular Vein.
S^n. Subclavian Vein.

looping of the veins, especially seen in the mandibular, external jugular, and femoral veins, has been much more conspicuous in the frogs this year (1908) than previously. The chief variations found are as follow:—

Anterior Vena Cava.—There is usually not only one lingual vein, but a number of smaller ones coming from the floor of the mouth and entering the mandibular vein, chiefly in front of the entrance of the main lingual vessel. Rarely, the lingual itself arises by several large branches which unite close to the external jugular vein. The mandibular vein receives generally a large branch from the skin just as it turns inwards at the angle of the jaw. Occasionally a connection was found between the two external jugular veins across the ventral surface of the body.

The second main vein of this system, the so-called innominate of the Amphibia, and its branches, are the most variable in the body. The innominate vein may be comparatively long, i.e., up to 5-6 mm. At other times, it is entirely absent, its two component branches entering the anterior vena cava side by side (see Text figure 5). Rarely, the internal jugular, subscapular, and main subclavian veins all enter a short, wide vessel, which joins the external jugular vein to form the anterior vena cava (see Text figure 6). As an exaggeration along

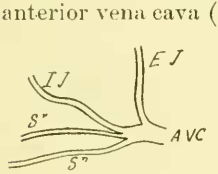


FIG 6

Abnormal precaval venous system of *Hyla aurea*.

(Reference letters as in Text-figure 5).

this same line of variation, the whole innominate vein, with a length of 1 mm., has been seen to empty into the subclavian vein, at about one-half of the length of the latter (see Text figure 7). A further development of the condition in which

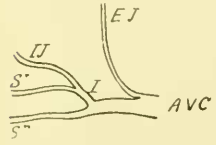
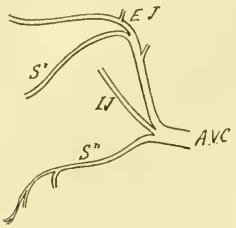


FIG 7

Abnormal precaval venous system of *Hyla aurea*.

(Reference letters as in Text-figure 5).

there is simply no innominate vein, is seen in a case (see Text figure 8) in which the subscapular vein entered the mandibular



Abnormal precaval venous system of *Hyla aurea*.

(Reference letters as in Text-figure 5).

FIG 8

just before the latter was joined by the lingual vein—the internal jugular uniting with the external jugular and subclavian to form the anterior vena cava. On the other hand, it is a comparatively common occurrence to find the subscapular vein entering at any point of the subclavian vein.

The internal jugular vein itself occasionally shows a curious branching (see Text figure 5). In addition to its usual branches in the head, it sometimes receives two very large dorsal or vertebral veins, and in addition, in two examples, these were joined by a very large vessel coming from the roof of the oesophagus. In one case, this originated in a large plexus. This takes place on each side of the body, this oesophageal vein running ventral to the brachial nerve and subclavian artery, and dorsal to the subscapular and subclavian veins.

With the exception of the variations mentioned above, the subclavian veins do not show any marked abnormalities. In one instance, however, a vein arising from the oesophageal wall, entered the subclavian vein, instead of going further forward to the internal jugular vein, as described above. It is also quite a common occurrence to find one, or often two vessels from the coracoid region entering the subclavian vein at varying distances along its length.

The Posterior Vena Cava appears free from variations.

The Portal Systems are also fairly constant in their arrangement. A few abnormalities, however, may occasionally be found, e.g., an extra renal portal vein on one or both sides, a

looping of the femoral vein just before its division into renal portal and pelvic veins, or a plexus with large or small vessels at the same part. In two specimens I came across a curious condition of the anterior abdominal vein, which, though full of blood posteriorly, stopped short, in one case, half way along its length, in the other somewhat further forward. In neither individual therefore, was the blood able to pass forwards to the liver in the usual direct manner from this vessel, nor was I able to find any abnormal communication with other vessels.

II.—Spinal Nerves.

Since the publication of my previous paper on the Variations of the Spinal Nerves of this form, some few additional points have come to light, although in the main there is nothing fresh.

I am adhering to the numeration of the nerves in this previous paper for the sake of easier comparison therewith.

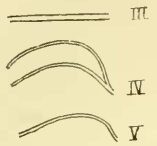
II.—The Hypoglossal. The muscular branches of this nerve vary considerably in their point of origin. Sometimes they arise much closer to the vertebral column than at others, and then often by a single large branch which can be easily seen without dissection. This, later, breaks up into the branches supplying the several muscles. This has been much more conspicuous this year than usual. The hypoglossal is usually a moderately thin nerve, but in one instance noted it was as large as the brachial nerve, which, however, was much smaller than usual. Here, also, a large additional coraco-clavicular nerve was given off from the hypoglossal.

This year there has been a marked tendency to a duplicating or splitting of the spinal nerves either as, or before they leave the spinal canal. This is true in a few cases of the hypoglossal, the two parts running side by side and each branching in the normal manner.

III.—The Brachial is very constant, though the same looping seen in the veins this year is seen in this nerve also, in a few instances. In one or two of these, the IInd nerve fused with one part of the loop, leaving it again before the junction.

IV.—In one instance IV. was equal in size to III., and the two completely fused together just after the coraco-clavicular had been given off. This is evidently an exaggeration of the

condition shown in Fig. 5, iii. (Sweet, '97). The duplication of nerves is seen also in this one (see Text figure 9 of the present



Brachial and two succeeding nerves of right side.

FIG 9

paper), the anterior division running sharply forwards first ventral to, then turning dorsal to, the transverse process of the IIIrd vertebra, and running back to accompany the posterior division to its destination.

V., *VI.* and *VII.* call for no comment, except that one may rarely be absent on one or both sides—especially the 5th—the vertebral column being normal in these cases.

VIII., *IX.*, *X.* and *XI.* are, as previously described, subject to considerable variation. The variations show no departure in general from those then given. Fig. I. (i) appears fairly often, and then generally with XI. entering the sciatic nerve, after the crural has been given off, as in Fig. 4 (i.). In cases where XI. is large, and has such an intimate relation with the sciatic plexus, one is generally sure of finding a XIIth nerve, indicating the more primitive condition.

This condition is somewhat similar to that shown by Cole for *Rana temporaria*, without a post-coccygeal nerve, and for *Rana esculenta*, with a post-coccygeal nerve.

A number of examples of double VIIIth nerves were found, generally on one side only. They were sometimes equal in size, less often the more posterior division was very fine indeed.

As examples of the more advanced condition of this plexus may be cited the following:—VIII. large, IX. normal, X. smaller than usual, XI. absent (cf. loc. cit., Fig. 2, viii.). In another case in which VIII. and IX. were equally large, and fused high up, to form the sciatic nerve, the Xth and XIth were very small indeed, and their plexus received a tiny branch from the fused VIII. and IX., and at a lower level gave back to them an even smaller twig.

XII. This is found in 3-4 per cent. of cases, as previously described, and only when XI. is larger than usual.

It will be seen that I am still of the opinion that, so far as evidence shows up to date, the sacral plexus appears to be moving forwards, the coccygeal nerve gradually diminishing in physiological importance, as previously shown by Adolphi ('93, '95, '98—) and myself ('97—). Cole (p. 116) acknowledges the fact that as "the vertebral axis shortens up from behind, forwards, to produce the complex known as the urostyle, several of the most posterior spinal nerves are eliminated in the process," as shown by Adolphi (loc. cit.). At the same time, he considers that the sacral plexus is moving back—i.e., he apparently believes that up to a certain stage a reduction of spinal nerves in the sacral region takes place, followed in the next stage by an addition of nerves in the same relative positions as were those which have been lost. Until we have much more definite evidence of such an apparently uneconomical method of development, either in the individual or the group, it is unnecessary to imagine such a process.

As to the statistical method employed by Adolphi and myself, which Cole considers open to criticism, while agreeing that the thickness of a nerve may not be an infallible guide as to its physiological power, it appears to me—in the absence of direct evidence to the contrary in the Amphibia—that it may be accepted as an indication of probable importance.

III.—Urinogenital System.

Variations in the structure of this system are very rare. In one instance, found this year, there was present on each side in a male frog, a medium-sized, well-formed oviduct. This extended from the funnel at the anterior end, as far as the middle of the length of the kidney, where it ended abruptly. For the greatest part of its length it coiled in the usual manner. The two sides were similar. No trace of a "Bidder's organ" could be found, and the vasa efferentia and fat bodies were normal. From a surface examination the testes also appeared normal, but a series of sections showed clearly the presence of 15-20 ova, scattered irregularly through the substance of the testes,

generally singly, but sometimes in groups of two. Here, for some reason or other, the Mullerian duct has gone on developing more than is usually the case in the male frog, and some of the cells of the germinal epithelium have formed ova; but still no communication has been established between the oviduct and the cloaca. There can be, therefore, no functional activity of the oviduct, at all events.

IV. Skeleton.

(i).—Vertebral Column.

Variations in the skeleton are also to be met occasionally. The most remarkable example which has been seen here is that shown in Pl. xix., Fig. 1—for which figure I am indebted to Professor Baldwin Spencer. In this individual (W), it will be seen that the neural arches, as well as the bodies of the vertebræ, are very much distorted, those of the 7th and 8th being fused together, that of the 9th being completely fused with the urostyle. The malformation of all the processes is very conspicuous. Although there is the correct number of transverse processes on the right side, their number and relationships on the left side are quite abnormal. On reference to the figure, it may be observed that the left transverse process of the 2nd vertebra has become articulated to the 1st vertebral body—that of the 3rd is now on the 2nd, and so on to the large transverse process of the sacral vertebra 9, which is attached to the hinder part of the left side of the fused 7th and 8th bodies—while the part of the urostyle representing the 9th body, has on its left side a small backwardly directed process, and on the right the large sacral process is articulated with it.

In a second individual (X) (see Pl. xix., Fig. 2), both sides of the skeleton showed a somewhat similar condition to that present on the left side of the previous one (W), i.e., the transverse processes of each of the 2nd to the 9th vertebræ are transferred to the vertebra in front. The 9th vertebra, which is not fused with the urostyle, has no true transverse processes. Its posterior zygapophyses, however, are very much elongated, and, viewed from below, may be seen to have a connection with the side of the neural arch, as though a rudimen-

tary transverse process on each side had become fused with the zygapophysis, as it elonganted to take on the general functions of the transverse processes. The bodies of vertebræ 1 to 7 are normal. That of 8 is procoelous, but is abnormal posteriorly where it has two convex surfaces, one on each side, as is normal for number 9. The latter, again, is abnormal anteriorly, its 2 concave surfaces fitting on to number 8. Posteriorly 9 is normal except that its 2 convexities are very prominent, and the urostyle is correspondingly deeply concave.

In yet a third individual (Y), (see Pl. xix., Fig. 3), exactly the same condition of the 8th and 9th processes and vertebræ is present: i.e., the sacral processes are on the 8th vertebra, and 9 carries two very long posterior zygapophyses, equal in size to the transverse processes of the 4th vertebra —but, as contrasted with (X), the rest of the vertebral column is quite normal. So that, while in (Y) the large processes of the 3rd vertebra are normal, in (X) they are situated on the 2nd vertebra. The centra of (Y) are very similar to those of (X), except that the hinder end of the 8th body is very irregular on the left side, the opposed part of the 9th being correspondingly irregular— the hinder end of 9 and the urostyle are normal.

It is not unusual to find processes on either or both sides of the urostyle itself in otherwise normal frogs (e.g., Pl. xix., Figs. 4 and 5). Sometimes these processes are as long as those of the 5th, 6th and 7th vertebræ, and evidently represent those of a potential 10th vertebræ fused with the urostyle. The bodies of the vertebræ of the sacral region are normal in these specimens.

Since writing the above, a 6th skeleton, evidently that of *Hyla aurea*, has been handed to me. This individual (V) is shown in Pl. xx., Figs. 8a, 8b. The whole vertebral column is very short. This is due, primarily, to a widespread fusion of parts in its anterior region. Vertebræ 6-9 are normal as regards size, shape and relationships, though the body of 8 shows hardly any ossification. The remaining vertebræ are, however, much changed. Vertebra 1 consists of a ventral body, carrying on its right side one half of the normal neural arch, with the right concave articulating surface, which receives the corresponding condyle on the right exoccipital bone. The left half of the

neural arch is wanting—and correspondingly the left exoccipital has no condyle, the vertebral column being simply very closely connected with the skull on the left—so closely that it is only after careful examination that one is sure that it is not fused. The bodies of the 2nd, 3rd, 4th and 5th vertebræ are completely fused, and somewhat distorted. This ventral fused mass is procoelous, and convex behind. The bodies of the 2nd, 3rd and 4th vertebræ are incomplete on the left side (see Pl. xx., Fig. 8b). The neural arches of the 2nd and 3rd, and of the 4th and 5th, are fused in a peculiar distorted way, which may be readily seen on reference to Pl. xx., Fig. 8a. The transverse processes, which are slightly broken, appear to have been nearly normal on the right side. On the left, however, those belonging to the 2nd and 3rd vertebræ are absent, the space left in this way and by the incomplete centra forming a long oval opening through which, presumably, the 2nd, 3rd, 4th and 5th spinal nerves left the spinal column on the left side. The transverse processes of the 4th and 5th vertebræ on this left side arise from the region of the anterior part of the 5th neural arch by a broad common base, which soon splits into 2, one turning outwards and forwards, the other running outwards and very slightly backwards. The transverse processes of the 6th and 9th are appreciably larger on the left than on the right. The general relations of the vertebræ will be seen clearly on reference to the Plate xx., Figs. 8a and 8b. The rareness of such variations in *Hyla aurea* may be guessed from the fact that the variations herein recorded have been gathered from over two thousand frogs.

Fusion of vertebræ is not unknown in the Anura, though I am not aware of its having been previously recorded in *Hyla*. In addition to the cases in *Pipa* and *Xenopus*, figured by Ridewood (1897), the following are the chief records available to me:—

1 + 2	Pelobates fuscus, symmetrical.		Adolphi, '95, figs. 2, 3
,,	Rana mugiens, not	,,	Benham, '94, figs. 1, 3, 4, 6
1 + 2 + 3,	Pelobates fuscus ,,	,,	Adolphi, '95, fig. 5
2 + 3	Bufo cinereus,	,,	,, '98, fig. 1
3 + 4	,, ,,	,,	,, ,, 2
,,	Rana mugiens, not	,,	Benham, '94, figs. 1, 2
3 + 4 + 5,	,, ,, ,,	,,	,, '94; figs. 7, 8, 9, 10

4 + 5 + 6,	Bufo cinereus, symmetrical.	Adolphi, '98, fig. 3
7 + 8	Rana mugiens, not ,,	Benham, '94, figs. 1, 2
8 + 9	Rana esculenta ,,	Howes, '93, fig. 1
,,	,, ,, ,, ,,	Cole, '01, fig. 1
,,	,, ,, ,,	Ridewood, '02, p. 46
8 + 9	Pelobates fuscus ,,	Adolphi, '95, figs. 10, 11
8 + urostyle	Bufo cinereus ,, ,,	Adolphi, '98, figs. 5, 6, 7, 8
8 + 9 + urostyle,		
	Bufo variabilis, nearly ,,	Adolphi, '93, fig. 4
,,	,, pantherinus ,, ,,	Benham, '94, fig. 16
9 + urostyle,		
	Bufo variabilis ,,	Adolphi, '93, figs. 6, 7
9 + 10 + (?)urostyle		
	Pelobates fuscus ,, ,,	Adolphi, '95, figs. 2, 3, 4, 6, 7, 8

From this table it is easily seen that the fusion of vertebræ 2, 3, 4 and 5, in individual (V) of Hyla is somewhat more extensive, resulting in greater distortion and loss of parts, especially as involving one of the condyles of the skull, and the 2nd and 3rd transverse processes, and the left side of the bodies, resulting in a shortening of the whole vertebral column. The curious arrangement found in (W), (see Pl. xix., Fig. 1), whereby each vertebra from 2-8 carries a transverse process belonging on the left, apparently to the vertebra behind, as well as its own on the right, is comparable in part with that shown by Benham ('94, Figs. 1 and 2), though brought about in a different manner. There is there, however, no interference with the arrangement of the sacral processes, such as we find here. In this respect this specimen of Hyla may rather be compared with the vertebral column figured by Adolphi ('98, Figs. 7 and 8), though not exactly similar even to that, the body of vertebra 9 being in that case still distinguishable from the urostyle, while here it is completely fused. The position of the sacral processes on 8 instead of on 9, as seen here in (X) and (Y), may be compared with Adolphi's ('98), Fig. 5, though there the 9th is indistinguishable from the urostyle, while here it is not in any way fused. A similar disjunction is seen in the specimen of *Rana temporaria*, quoted by Lloyd Morgan (Nature, vol. 35, p 53), in which the right sacral process is carried by the 9th vertebra,

while the left sacral process is carried by the 8th—also somewhat similarly in *Bombinator* sp., by Howes, in which he found the right sacral process on the head of the urostyle (= "coccygeal sacrum"), the left being, presumably, on the 9th vertebra.

Accepting the view that the positions of the vertebræ are determined by the original myotomes of the embryo, the pelvis being only secondarily affected, it is easy to understand that not only may any vertebra become sacral in function, but, further, if the iliac cartilages be disturbed or irregular in position, the sacral processes will become correspondingly irregular in their attachments to the relatively fixed vertebræ.

The existence of the processes belonging to a potential 10th vertebra, which is not infrequent in *Hyla aurea*, and is exemplified in Pl. XIX., Figs. 1, 4 and 5, has also been noted by Adolphi in *Bufo cinereus*, etc.

In view of our present unsatisfactory method of estimating the homologies of similar structures (see Parker, '96, and Bateson, '92), I have simply recorded in detail the variations found, numbering the parts concerned according to the conventional manner, and giving exact drawings to scale of the same.

(ii).—Appendicular Skeleton.

The curved epicoracoids characteristic of the Hylidae, as of other families of the Arcifera, vary somewhat in their relation to one another in *Hyla aurea*. The more usual condition is that in which, while not firmly attached to one another, the right epicoracoid lies ventral to the left—but in approximately 4 per cent. of individuals the reverse is the case, the right being dorsal to the left.

In a few instances variations are found in the limbs. Thus in one case, while one foot was quite normal, the phalanges of the other foot showed a curious variation from the numbers characteristic of each toe (see Pl. xx., Fig. 6). Thus, instead of the 1st, 2nd, 3rd, 4th and 5th toes containing 2, 2, 3, 4, 3 phalanges respectively, as is usually the case, they here contained 2, 3, 4, 3 and 3 respectively—i.e., the second and third toes had each one more phalanx than usual, and the fourth one less than usual, the third toe being the longest, instead of

the fourth, as is usual. The length of the metatarsals also was abnormal—the 4th, and especially the 5th, being much shorter than the 3rd, instead of, as usual, equal in length with it.

In another individual (Pl. xx., Figs. 7a and 7b), both feet were abnormal, and also unlike one another. In the left foot there were only 4 toes, the metatarsal and phalanges of the first being absent. In the right foot there were 6 toes, an additional metatarsal and 2 phalanges being present on the postaxial side of the normal 5th toe. The metatarsals of the 3rd, 4th and 5th toes are normal, that of the additional toe being only equal in length to that of the 2nd. The bases of the 4th and 5th metatarsals, while not completely fused, are partially so.

In a third individual, the right foot was normal, as also the calcar, 3rd, 4th and 5th toes of the left foot. The 1st toe on the left foot contained only the one metacarpal and no phalanx, as in the thumb. The 2nd toe contains only the one metacarpal and one phalanx. The metacarpals of both 1st and 2nd toes are swollen distally.

There is no appreciable difference in the other bones of the limb in any of the above cases.

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EXPLANATION OF PLATES XIX. AND XX.

Fig. 1.—Whole vertebral column of specimen W, of Hyla aurea, showing fused 7th and 8th vertebræ, and 9 and urostyle.

Fig. 2.—Whole vertebral column of specimen X, with each pair of transverse processes attached to the vertebra in front of the normal one.

Fig. 3.—Vertebræ 6, 7, 8, 9 and urostyle of specimen Y, showing sacral processes on vertebra 8.

Figs. 4 and 5.—Vertebræ 8, 9, and urostyle of specimens ZA and ZB, showing well-developed processes on the urostyle.

Fig. 6.—Right foot, showing abnormal 3rd and 4th toes, dorsal view.

Figs. 7a, 7b.—Right and left feet respectively, showing abnormality in toes of each. Dorsal view.

Figs. 8a, 8b.—Whole vertebral column of individual V, showing fusion of vertebræ, etc. 8a, Dorsal view. 8b, Ventral view.

In each case the figures are life-size.